Technology Transfer and Learning : A Study on the Interaction between Japanese Firms and the Innovation Systems of China

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論文内容要旨

Over the past decades, technological and economic links between Japan and China have dramatically flourished in the context of increasingly internationalized marketing, production and innovation. However, there is little existing literature that gives a comprehensive study on the integration between Japanese firms and the innovation systems of China. To fill this gap, the main objective of this study is to explore the interaction between Japanese firms and the innovation systems of China from the perspective of technology transfer and learning. By employing case study, historical and comparative analysis, this study explores the dynamics, patterns and mechanisms of technology transfer from Japan to China.

This dissertation is organized into six chapters.

In the first chapter, a broad context of economic and technological linkages between Japan and China is discussed. The research questions and objectives are proposed. Three hypotheses are set up. They are: (1) Technology transfer and technological leaning evolve in a sequentially staged model; (2) Technology transfer from Japanese firms to China has industry-specific characteristics; (3) Japanese firms have a positive technology spillover effect on the innovation systems of host region. The methodology of the study is also covered in this chapter. The survey methods, that is, interview survey and questionnaire survey are discussed in detail.

The second chapter provides the theoretical background of the study. First, it sheds light on catch up theory and technology transfer and technological learning. Then the concepts concerning innovation systems are considered. Third, the characteristics of transnational corporations (TNCs) and global production and innovation networks are examined. Finally, this chapter discusses the relationship between TNCs and the innovation systems of host region. The literature review shows that developing country's catch-up needs technology transfer from foreign country. Technological learning is an important means by which exogenous technological capabilities transferred from foreign countries are transformed into endogenous technological capabilities. The efforts of catch up, technology transfer and technological learning have to be set within the context of the national,

regional or sectoral systems of innovation. Within the innovation systems of developing country, TNCs are important actors because they possess several owner specific-advantages, such as sophisticated, modern technologies, advanced organizational and technological capabilities. With the development of global production and innovation network, TNCs are increasingly integrated into host region's economy. TNCs-affiliates can have positive effects on the host economy and its innovation systems, especially when they are the source of spillovers that enhance technological learning by local firms.

Chapter 3 first gives an overview of China's economic development and the dynamics of China's innovation systems in the past decades. Then an evolutionary process of technology transfer from Japan to China is examined. Three decades of economic reform in China have achieved remarkable economic growth. The rapid growth has been realized through high growth of capital investment, abundant and cheaper labor supply, and technological changes. China has attracted huge amounts of FDI inflows and FDI firms have become an important element of Chinese economy. Economic development and reforms during the past decades have altered the structure and dynamics of China's innovation systems. There are overall positive developments in China's apparent capacity to introduce diffuse and exploit technological innovations. The changes that are underway in the innovation systems are the results of recent trends in the internationalization of innovation as well as the reconstruction of the domestic economy. Among the changes are: emphasis on the coordinated development of R&D; increased efforts on R&D in applied science and technology; establishment of horizontal links between scientific research institutes, industries and local governments; acceleration of the commercialization of scientific research results; and restructuring the funding systems to encourage research institutes to undertake RD oriented towards economic development.

Based on the analysis of China's economy and its innovation systems, this chapter employs macro level data to reveal the dynamic process of technology transfer from Japan to China. It is shown that technology transfer evolves in a three-staged model. In the first stage, technology was transferred mainly by China' purchase of capital goods and technology licensing from Japan. In the second stage, FDI from Japan began to play an important role in transferring technology. In the third stage, more and more Japanese firms began to do oversea R&D in China. Technology was transferred through Japanese firms' R&D activities.

Chapter 4 uses qualitative data, namely case studies in China's electronics and automobile industries to enquire technology transfer and learning in the context of Japanese firms' interaction with the innovation systems in these two sectors. The reasons to choose these two industries are: First, both industries are "pillar industry" that Chinese government views as strategically important. Second, both industries have high weight in China's economy. Third, Japanese firms have largest amount of investment in these two industries. In this chapter, each of the two industries is assessed on the strategy, process, and practice of Japanese firms as well as technology transfer and learning in each industry in China. In each industry, a great deal of data on industrial development, government policies, technological changes are analyzed to place the case studies in context.

This chapter's study reveals that Japanese firms have increasingly integrated into China's key industrial sectors of electronics and automobile. With the increasing integration, technology

transfer and technological learning are deepening. Both in electronics and automobile industries, a sequentially staged process of technology transfer and leaning are identified. In the first stage, technology was transferred by China's purchase of capital goods and technology import. In the second stage, technology was transferred through Japanese electronics and automobile firms' direct investment in China. In the third stage, technology was transferred through Japanese firms' R&D activities in China.

Japanese firms' patterns in the key industrial sectors showed contrasting strategic consideration of technology transfer. In electronics industry, Japanese firms seemed to pursue FDI with motives similar to those in Southeast Asia and other developing areas of the region. By transferring technology and localizing production, Japanese firms established their position in China's electronics industry. For automobile industry, however, the pattern differed. In the 1980s and 1990s, Japanese firms' strategy was export-oriented. Both political and economic considerations gave the large Japanese car firms pause in moving to China in the 1980s and 1990s. After China' access to the WTO, Japanese auto firms changed their strategies and began their heavy investment and technology transfer to China.

Japanese firms' technology transfer provides the "windows of opportunity" for Chinese firms' technological learning. Technology transfer from Japanese electronics and automobile firms provides Chinese indigenous firms learning opportunities for technology upgrading. Two firm cases, Changhong and Little Swan, show that active learning fosters the firms to assimilate the technology transferred from Japan. Consistent with the sequential technology transfer, technological learning also shows a staged model. In the first stage, the firms imported capital goods and technology from Japanese firms and learned by doing and using; then they learned by adapting, by hiring, and by training, etc; in the third stage they learned by creating and searching by building their own R&D activities and doing co-development with TNCs from Japan or other countries.

Chapter 6 explores the interaction between Japanese firms and the regional innovation systems in Wuhan city, focusing on the technology transfer of Japanese firms in this region. Wuhan city region was selected for the following reasons. First, Chinese government's regional development strategy have given an emphasis on the development of central areas since the year 2005. Wuhan, as the heart of the central region, plays an important role for the region's development. Second, the existing literature on the relationship between foreign firms and China's regional development and local innovation systems focus on coastal area. This study aims to filling a research gap in this field. Third, in Wuhan, Japan has become the biggest FDI source nation.

First, this chapter outlines the natural and economics conditions as well as the investment environment of Wuhan city. It demonstrates the characteristics of Wuhan in China's economy by comparing the main economic indictors between Wuhan and the average level of China.

Second, this chapter introduces the regional innovation systems in Wuhan. It mainly focuses on the two development zones and Wuhan's scientific and technological infrastructure.

Third, According to the interview survey and questionnaire survey, this chapter explores in depth the technology transfer of Japanese firms in Wuhan region. The characteristics of technology transfer were checked in the following aspects: (1) the involvement and characteristics of Japanese firms in Wuhan city; (2) technology transfer within Japanese firms. This includes products and equipments; extent of R&D; Human resources training; (3) technology transfer through backward

and forward linkage; (4) other technology transfer mechanisms. The examination of the transfer process and effects by interviews and questionnaire shows that Japanese firms have positive technology spillover effects on the host region. Japanese firms bring new products and advanced equipments into the host region. They employ local personnel and offer intensive human resources training. As a result of the recruitment and training, the flow of production skills and management knowledge increase the knowledge stock of local personnel. The outflow of local personnel in Japanese firms is high. Technician and engineers are an important content of outflow staff. The local innovation systems benefit from the movement of qualified local personnel, which is observed from directly diffusing production know-how and management skills. Japanese firms also generate positive backward and forward linkages to indigenous firms. The extent of Japanese firms' R&D activities in Wuhan is still weak, and also, these firms' cooperation with local universities and research institutes is minimal or non-existent.

Chapter 6 summarizes the study and gives the policy implication to promote technology transfer and learning.

First, this chapter reflects upon the changes in China's innovation systems, trying to demonstrate how the innovation systems provide conducive environment for technology transfer and learning. Second, this chapter revisits the research hypothesis and highlights the findings of this study. The findings of the study are: (1) technology transfer from Japan to China evolves in a sequentially staged model, from trade, via FDI, and to R&D; (2) Chinese firms' technological learning evolves in a sequentially staged model; (3) technology transfer has industry-specific characteristics; (4) Japanese firms have positive technological spillover effects on host region, but technology transfer by some channels is still limited, especially low extent of local R&D activities and weak R&D cooperation between Japanese firms and local universities and research institutes.

Then, this chapter proposes policy recommendations according to the theory background and the results of this empirical research. The study found that there are various channels for technology transfer. However, technology transfer by some channel is still limited. Chinese government should take measures to improve these channels. Especially, the study found that foreign firms' extent of local R&D activities is still weak. There is little cooperation between foreign firms and local universities and R&D institutes. Government policy should develop an appropriate environment allied with incentive structures to encourage foreign firms to increase levels of R&D. Also, government should encourage cooperation between local university and R&D institutes and foreign firms. Meanwhile, policy should increase the quality, industry-relevance, and openness of universities and R&D institutes. Two firm case studies in electronics industry shows that exogenous technological capability transferred from foreign firms can be transformed into indigenous technological capabilities. Government policy should encourage and support domestic firms' technological learning efforts.

At the last, the chapter shows its limitation and puts forward further research. This study has concentrated on the situation of Wuhan and did not compare much between Wuhan and other regions of China due to the limitation of research data. Therefore, this study is not free from bias. Moreover, this study is mainly based on limited cases, so it is also not free from bias duo to the choice of specific cases. The other limitation is that only two industries are studied. For further research, more quantitative research is desirable. The impact of technology transfer and technological learning on the collaboration between Japan and China should be explored further.

論文審査結果の要旨

近年、製造拠点、市場、イノベーションのグローバル化が進む中、日本と中国の間の経済交流は飛躍的に発展してきた。これまで、日系企業の中国進出は、安価な労力を求めた製造拠点の移動、巨大な消費市場への参入といった視点から着目されてきたが、日系企業が中国のイノベーション・システムに及ぼす影響に関する研究は数少ない。本論文の目的は、技術移転及び技術学習の視点から、日系企業が中国のイノベーション・システムに及ぼす影響について明らかにすることである。中国の経済発展の歴史的な背景を踏まえ、日系企業の中国進出の現状を確認した上で、技術移転のパターンの比較分析を電子産業と自動車産業を対象として行い、中国政府が１９９２年に制定した中部開発区の中核的都市であり、日系企業の誘致を活発に行っている武漢に焦点を合わせ、日系企業のケース・スタディーを基に日系企業から地域イノベーション・システムへの技術移転及び技術学習のメカニズムを解明したものであり、全文６章である。

第１章は序論であり、本研究の背景と目的及び仮説、研究方法について述べている。

第２章では、先行研究に基づき、理論的な枠組みを構築している。まず、発展途上国における技術のキャッチ・アップのプロセスに着目した技術移転及び技術学習、イノベーション・システムの概念整理を行い、多国籍企業の特徴を明らかにした上で、多国籍企業と受入国との関係を、特に開発途上国への技術移転の視点から分析している。

第３章では、中華人民共和国の成立以降の中国経済の制度面、政策面の変遷、海外直接投資の中国経済にもたらした影響、中国の海外直接投資誘導政策の効果について概観した上で、日系企業の対中国海外直接投資の状況をマクロな視点から分析している。また、受け皿となる中国のナショナル・イノベーション・システムの戦後の変遷、日系企業からの技術移転の状況を考察している。

第４章では、中国の電子産業と自動車産業に焦点を合わせ、産業レベルのイノベーション・システムの分析を行っている。産業の現状、産業政策、日系企業からの技術移転の状況を概観し、ケース・スタディーとして電子産業の長虹（Changhong)、自動車産業の小天鵝（Little Swan）の２社を分析している。日系企業からの技術移転がシーケンシャル・ステージ・モデルに沿って起こること、分野によりステージ間の移行のスピードが異なることを明らかにしている。また、受け皿となる現地企業においては、技術学習のプロセスが業種により異なることも明らかにしている。

第５章では、地域イノベーション・システムの視点からの武漢の現状、日系の海外直接投資の状況を示した上で、武漢における実地調査（２２社へのインタビュー調査を含む）及びアンケート調査を基に、技術移転及び技術学習のメカニズムを分析している。資本財、海外直接投資、研究開発、バックワード・リンケージ、フォーワード・リンケージ、人材の養成と移動を介した技術移転のメカニズムを明らかにしている。またシーケンシャル・ステージ・モデルに沿って技術移転が進んでいることを明らかにしている。研究開発のステージでは、電子産業関連の企業と自動車産業関連の企業とでは軌道が異なることを実証している。

第６章は、結論である。

以上要するに本論文は、日系企業が中国のイノベーション・システム、特に地域イノベーション・システムに及ぼす影響を技術移転の視点から明らかにしたものであり、中国政府にとっては技術移転誘導政策、技術学習支援政策を策定する際に示唆を与えるものと考えられる。また、開発経済学の視点からも、本論文が明らかにした技術移転メカニズムは先進国から開発途上国への技術移転支援を行う際により効果的な施策を講じることに役立つと考えられる。

よって，本論文は博士(工学)の学位論文として合格と認める。